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$$2^{a_1+6}.3^{a_2+1}.5^{a_3}.7^{a_4}=(2^{a_1+1}-1)(3^{a_2+1}-1)(5^{a_3+1}-1)(7^{a_4+1}-1) \text{ ....}(7).$$

Now n may be so taken that

$$3^{a_2+1}-1=(3^{2n+1}-1)(3^{2n+1}+1)(3^{2(2n+1)}+1)(3^{4(2n+1)}+1) \text{ ....}, \text{ ....}(8).$$

The last factor written introduces the prime 41, and therefore not more than three factors can be considered. It may easily be shown that $3^{2n+1}-1$ is not divisible by 5 or 7, and that it contains the factor 2 but once. Therefore, $3^{2n+1}-1=2$. Hence, $n=0$. Equation (8) now yields $a_2=1$ or 3.

A trial of each of the eight possible cases produced by every possible combination of the values $a_2=1$ or 3, and $a_1=1$, 2, 3, or 5, will result in finding but one number of the type here considered, namely, $2^5.3^3.5.7$.

MECHANICS.

187. Proposed by **M. E. GRABER, A. M.**, Heidelberg University, Tiffin, Ohio.

Find the path described by a particle acted upon by a central force, the force being directly proportional to the distance of the particle.

Solution by **G. W. GREENWOOD, M. A.**, McKendree College, Lebanon, Ill.

Take coördinate axes through the center of force, and let μ^2 be the force on a particle of unit mass at the unit distance. Then the equations of motion are

$$\frac{d^2x}{dt^2}=-\mu^2 r\cos\theta=-\mu^2 x,\quad \frac{d^2y}{dt^2}=-\mu^2 r\sin\theta=-\mu^2 y.$$

Integrating the equations of motion we have

$$x=a\cos\mu t+b\sin\mu t,\quad y=c\cos\mu t+d\sin\mu t.$$

$\therefore (cx-ay)^2+(dx-by)^2=(bc-ad)^2$, which is an ellipse.

Also solved by S. A. Corey, and Henry Heaton.

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PROBLEMS FOR SOLUTION.

ALGEBRA.

262. Proposed by **REV. R. D. CARMICHAEL**, Hartselle, Ala.

Sum to infinity the series $\dfrac{n}{(4n^2-1)^2}$, beginning with $n=1$, n being always odd.

263. **Proposed by O. E. GLENN, Ph. D., Springfield, Mo.**

Express the transcendentals e and π in the form of infinite continued fractions.

264. **Proposed by O. E. GLENN, Ph. D., Springfield, Mo.**

Express the invariant $2(a_0a_4-4a_1a_3+3a_2^2)$ of the binary quartic $a_0x_1^4+4a_1x_1^3x_2+6a_2x_1^2x_2^2+4a_3x_1x_2^3+a_4x_2^4$ in terms of roots of the latter.

AVERAGE AND PROBABILITY.

177. **Proposed by J. EDWARD SANDERS, Reinersville, Ohio.**

Two random planes cut a given sphere. What is the chance that they intersect within the sphere?

CALCULUS.

220. **Proposed by C. N. SCHMALL, College of the City of New York, New York City.**

To determine the least polygon of n sides that can be described about a given circle.

DIOPHANTINE ANALYSIS.

135. **Proposed by A. H. HOLMES, Brunswick, Maine.**

In the equation in Diophantine Analysis: $2x^2+2x+1=\square=u^2$, show that u is always the sum of two squares.

136. **Proposed by A. H. HOLMES, Brunswick, Maine.**

Given $7x^2-111=y^2$. Required a value for y greater than unity which shall be a prime integer.

GEOMETRY.

288. **Proposed by C. N. SCHMALL, College of the City of New York, New York City.**

From a point P on a given circle to draw two chords such that, (α) chord PA : chord $PB=m:n$ (a given ratio), and, (β) arc PA : arc $PB=1:3$.

289. **Proposed by J. J. QUINN, Ph. D., Warren, Pa.**

(a) Suppose a circle described around the origin. Then at the end of a uniformly revolving radius r, a line equal to the diameter is pivoted. Find the equation of the locus of its extremity, if for every unit of angle its projection on the X axis is a constant linear unit, being the same part of the diameter as the angle is of π radians.

(b) Show how it can be applied to the trisection or multisection of an angle.